

## Spectroscopic ellipsometry applied to characterization of GaN and AlGaN structures

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Reproducible growth of high quality (AlGaN) hetero-structures requires fast and efficient characterization of layer thickness and structural quality. Spectroscopic ellipsometry (SE) has long been recognized as a powerful technique for the characterization of conventional III-V hetero-structures. Different studies have already been devoted to the characterization of GaN and AlGaN by SE.

In the proposed paper, we show that SE can be applied to the characterization of this kind of material not only to control the layer thickness and composition but also to understand the structural behavior of these complex structures. SOPRA is well known in the field of spectroscopic ellipsometry for more than 15 years. Different kinds of instruments are currently proposed with variable wavelength range from vacuum UV (140nm) to near infrared (18 $\mu$ m). In the visible range and the near UV the optical indices of III-V nitrides is very dependent on their electronic structure and in particular the band gap energy which depends on the material composition. As an example, we have reported the optical indices of GaN and AlGaN extracted point by point at each wavelength without any mathematical model. The GaN layer was deposited alone on sapphire substrate (2.3 $\mu$ m thick homogeneous layer), and the AlGaN layer was deposited on top of the same kind of GaN layer. On Fig. 2, we have reported the experimental SE measurement on the bilayer structure. The simulation is made including an additional top surface roughness. This imperfection must be taken into account to get a good agreement with the measurement.

The proposed will give more results on the characterization of III-V nitrides by SE not only the UV-visible range but also in the infrared and in the vacuum UV. Results will be compared to other experimental techniques like grazing x-ray reflectance and x-ray diffraction. The interest to control the growth of this kind

of material by rapid multichannel SE will be also examined.

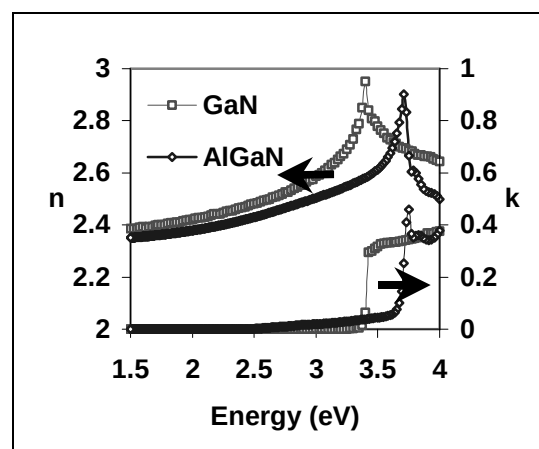


Fig. 1 : GaN and AlGaN optical indices extracted by SE.

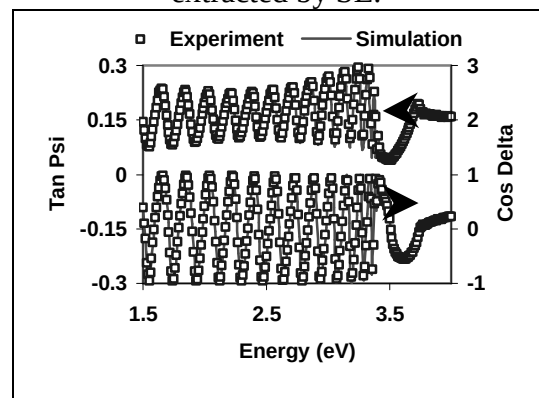


Fig. 2 : Experimental and simulated ellipsometric spectra of a AlGaN (111.9nm) /GaN(1250nm)/Sapphire.